1. (Original) An apparatus for use with a motor controller that receives a command velocity and that applies voltages to drive a motor at the command velocity, the apparatus comprising:

a dual inertia lost motion assembly including a motor and a load couplable to the motor, the lost motion assembly characterized by at least some lost motion between the motor and the load, the motor and load together characterized by a total assembly inertia;

an acceleration error determiner for generating an acceleration error that is the difference between a derivative of the command velocity and a motor acceleration value; and

a low pass acceleration error filter filtering the acceleration error and having a gain set as a percentage of the total assembly inertia, the acceleration error filter providing the filtered signal to the controller, the controller using the filtered signal to adjust the applied voltages.

2. (Original) The apparatus of claim 1 wherein the gain is between 40% and 60% of the total assembly inertia.

3. (Original) The apparatus of claim 2 wherein the gain is approximately 50 percent of the total assembly inertia.

4. (Original) The apparatus of claim 3 wherein the controller includes a second order velocity error filter having a velocity error time constant and wherein the acceleration error filter has an acceleration error time constant that is approximately three times the velocity error first order time constant.

5. (Original) The apparatus of claim 1 wherein the gain is 52.4 percent of the total assembly inertia.

6. (Previously Presented) An apparatus for use with a motor controller that receives a command velocity and that applies voltages to drive a motor at the command velocity, the apparatus comprising:

a dual inertia lost motion assembly including a motor and a load couplable to the motor, the lost motion assembly characterized by at least some lost motion between the motor and the load, the motor and load together characterized by a total assembly inertia;

an acceleration error determiner for generating an acceleration error that is the difference between a derivative of the command velocity and a motor acceleration value; and

a low pass acceleration error filter filtering the acceleration error and having a gain set as a percentage of the total assembly inertia, the acceleration error filter providing the filtered signal to the controller, the controller using the filtered signal to adjust the applied voltages;

wherein the controller includes a velocity error filter having a velocity error time constant and wherein the acceleration error filter has an acceleration error time constant that is between two and four times the velocity error time constant.

7. (Original) The apparatus of claim 6 wherein the acceleration error time constant is approximately three times the velocity error time constant.

8. (Original) The apparatus of claim 1 wherein the gain G is determined by solving the following equation:

$$G = \frac{-(1+R)}{2R} + \frac{\sqrt{5R^2 - 2R + 1}}{2R}$$

where R is (m1 + m2)/m1 and m1 and m2 are the motor and load inertias, respectively.

9. (Currently Amended) The apparatus of claim ~~9~~ 8 wherein the controller includes a velocity error filter having a velocity error time constant Tv and wherein the acceleration error filter has an acceleration error time constant Tf that is approximated by solving the following equation:

$$T_f = T_v(1+G)/G.$$

10. (Previously Presented) An apparatus for use with a motor controller that receives a command velocity and that applies voltages to drive a motor at the command velocity, the apparatus comprising:

a dual inertia lost motion assembly including a motor and a load couplable to the motor, the lost motion assembly characterized by at least some lost motion between the motor and the load, the motor and load together characterized by a total assembly inertia; and

an acceleration feedback loop including a low pass acceleration error filter where the loop gain is between 40% and 60% of the total inertia, the low pass filter providing a filtered signal to the controller;

wherein the controller includes a second order velocity error filter having a velocity error time constant and wherein the acceleration error filter has an acceleration error time constant that is between two and four times the velocity error first order time constant.

11. (Original) The apparatus of claim 10 wherein the gain is approximately 50%.

12. (Cancelled).

13. (Previously Presented) The apparatus of claim 10 wherein the acceleration error time constant is approximately three times the velocity error time constant.

14. (Original) The apparatus of claim 10 wherein the loop gain G is determined by solving the following equation:

$$G = \frac{-(1+R)}{2R} + \frac{\sqrt{5R^2 - 2R + 1}}{2R}$$

where R is (m1 + m2)/m1 and m1 and m2 are the motor and load inertias, respectively and, wherein, the controller includes a velocity error filter having a velocity error time constant Tv and wherein the acceleration error filter has an acceleration error time constant Tf that is approximated by solving the following equation:

$$T_f = T_v(1+G)/G.$$

15. (Previously Presented) An apparatus for use with a motor controller that receives a command velocity and that applies voltages to drive a lost motion motor-load assembly including a motor and a load couplable to the motor, the lost motion assembly characterized by at least some lost motion between the motor and the load, the motor and load together characterized by a total assembly inertia, the apparatus comprising:

an acceleration feedback loop including a low pass acceleration error filter where the loop gain is between 40% and 60% of the total inertia, the low pass filter providing a filtered signal to the controller;

wherein the controller includes a second order velocity error filter having a velocity error time constant and wherein the acceleration error filter has an acceleration error time constant that is between two and four times the velocity error first order time constant.

16. (Original) The apparatus of claim 15 wherein the gain is approximately 50%.

17. (Previously Presented) The apparatus of claim 16 wherein the acceleration error filter has an acceleration error time constant that is approximately three times the velocity error time constant.

18. (Original) The apparatus of claim 15 wherein the loop gain G is determined by solving the following equation:

$$G = \frac{-(1+R)}{2R} + \frac{\sqrt{5R^2 - 2R + 1}}{2R}$$

where R is (m1 + m2)/m1 and m1 and m2 are the motor and load inertias, respectively.

19. (Previously Presented) A method for use with a motor controller that receives a command velocity and that applies voltages to drive a lost motion motor-load assembly including a motor and a load couplable to the motor, the lost motion assembly characterized by at least some lost motion between the motor and the load, the motor and load together characterized by a total assembly inertia, the method comprising the steps of:

providing an acceleration feedback loop from the motor to the controller;

providing a low pass acceleration error filter within the feedback loop where the filter gain is between 40% and 60% of the total inertia;

wherein the controller includes a second order velocity error filter having a velocity error time constant and wherein the step of providing the low pass acceleration filter includes providing an acceleration error time constant that is between two and four times the velocity error first order time constant.

20. (Original) The method of claim 19 wherein the gain is approximately 50%.

21. (Previously Presented) The method of claim 19 wherein the step of providing an acceleration error filter having an acceleration error time constant that is between two and four times the velocity error time constant includes providing an acceleration error filter having an acceleration error time constant that is approximately three times the velocity error time constant.

22. (Original) The method of claim 19 wherein the loop gain G is determined by solving the following equation:

$$G = \frac{-(1+R)}{2R} + \frac{\sqrt{5R^2 - 2R + 1}}{2R}$$

where R is (m1 + m2)/m1 and m1 and m2 are the motor and load inertias, respectively.